



(19)

Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 709 592 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
12.01.2000 Bulletin 2000/02

(51) Int Cl.7: **F16D 55/22, F16D 65/095**

(21) Application number: 95116680.0

(22) Date of filing: 23.10.1995

(54) Disc brake

Scheibenbremse

Frein à disque

(84) Designated Contracting States:
DE FR GB

(30) Priority: 31.10.1994 JP 26684794

(43) Date of publication of application:
01.05.1996 Bulletin 1996/18

(73) Proprietor: Sumitomo Electric Industries, Ltd.
Osaka 541 (JP)

(72) Inventor: Ohishi, Hidenori, c/o Itami Works of
Itami-shi, Hyogo (JP)

(74) Representative: Schieschke, Klaus, Dipl.-Ing.
Patentanwälte
Eder & Schieschke
Elisabethstrasse 34
80796 München (DE)

(56) References cited:
GB-A- 905 797

GB-A-1 173 410

EP 0 709 592 B1

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

[0001] The present invention relates to a disc brake including a torque-carrying plate having a torque-carrying surface of improved design so that it can support the inner pad stably until it is completely worn out even if the torque-carrying plate is thinner than conventional plates.

[0002] Known floating-caliper type disc brakes include one type in which its inner pad, biased by a brake piston, is in abutment with a fixed torque-carrying plate so that the brake torque applied to the inner pad is carried on the torque-carrying plate, whereas the outer pad is fixed to the outer portion of the caliper so that the brake torque applied to the outer pad is carried on the caliper.

[0003] In this type of disc brake, if at the start of use of the pad the entire torque-transmission surface formed on the backing plate of the inner pad is in contact with the torque-carrying surface (if not, that is, if the torque is transmitted not through the entire torque-transmission surface but only through part of it, the torque-carrying surface and the torque-transmission surface tend to be damaged), the width (in the axial direction of the disc) of the torque-carrying surface of the torque-carrying plate has to be determined taking into account the sliding amount of the inner pad when it is completely worn out.

[0004] Otherwise, when the inner pad has been completely worn out, it will come off the torque-carrying plate, so that a large load will act on pad pins which support the pads so as to be slideable in the axial direction of the disc. If the inner pad is supported on the torque-carrying plate, it will drop off, so that the disc brake will completely lose its braking function.

[0005] For the above reasons, the torque-carrying plate has to be sufficiently thick so that it can support even a pad that has been completely worn out.

[0006] Such a torque-carrying plate is formed by blanking a steel plate because blanking is higher in mass-productivity than casting. The thinner such blanked plate, the more easily it can be machined. Also, the thinner the torque-carrying plate, the smaller the total weight of the disc brake.

[0007] But in conventional disc brakes of this type, since the width of the torque-carrying surface is equal to the thickness of the torque-carrying plate, it is impossible to reduce the thickness of the plate below a certain point. Also, since thicknesses of blanked plates tend to vary at their edges, that is, inaccuracy in size, it is necessary to correct such inaccuracies by machining so that the torque-carrying surface has a sufficient width. This machining work is troublesome. The torque-carrying plates thus obtained are not light enough.

[0008] Further prior art uses a U-shaped torque-carrying plate to guide the inner and outer pads (GB-A-1 173 410). Since it is difficult to form a thick plate member into such a U-shaped plate, thin plates are used for con-

ventional U-shaped torque-carrying plates. In the reference in order to reinforce the thin U-shaped torque-carrying plate, a zigzag configuration is used.

[0009] An object of the present invention is to provide a disc brake having a torque-carrying plate which is thinner than conventional such plates and yet capable of supporting the inner pad stably until it is completely worn out.

[0010] According to the present invention, there is provided a disc brake comprising a disc, a brake piston, an inner pad and an outer pad disposed opposite to each other on both sides of the disc and adapted to be brought into frictional contact with the disc, and a fixed torque-carrying plate, the inner pad abutting the torque-carrying plate when it is urged by the brake piston, the torque-carrying plate adapted to carry brake torque applied to the inner pad, the torque-carrying plate having a torque-carrying surface of a zigzag shape comprising a plurality of protrusions extending in the axial direction 15 of the disc so as to increase the width of the torque-carrying surface to such an extent that the inner pad can be supported on the torque-carrying surface even when the inner pad has been completely worn out, the torque-carrying surface being symmetrical with respect to a longitudinal centerline of the torque-carrying surface.

[0011] The torque-carrying surface formed with protrusions so that it has a zigzag configuration has a width W (in the axial direction of the disc) larger than the thickness w of the plate itself. Thus, it is possible to reduce 20 the thickness of the torque-carrying plate compared with conventional plates. Such a plate can be formed easily by blanking. A disc brake using such a thin torque-carrying plate is sufficiently lightweight.

[0012] Since the width of the torque-carrying surface is increased in the above manner, no extra machining is necessary to correct the inaccuracy in size when the plate is formed by blanking (to increase the width of the torque-carrying surface). Due to this and the fact that the plate is sufficiently thin, it is possible to cut down the 25 manufacturing cost as well as the material cost.

[0013] Since the torque-carrying surface is symmetrical with respect to its longitudinal centerline, this surface can carry the brake torque stably from the time when the inner pad is brand-new until it is completely worn out.

[0014] If the point at which the brake torque acts on the disc moves from the point near its outer periphery toward its center or vice versa, the length of moment arm and thus the surface pressure that acts on the torque-carrying surface vary. Namely, If the point at 30 which the brake torque acts changes with the progression of wear in such a way that the length of moment arm changes, the brake torque that acts on the torque-carrying surface also changes. This results in unstable braking. Also, this may cause uneven damage to the torque-carrying surface, which will lead to the shortening of the life of the disc brake.

[0015] According to the present invention, the torque-carrying surface is symmetrical with respect to its longi-

tudinal centerline, so that the average length of moment arm remains unchanged from the time when the inner pad is brand-new until it is completely worn out. This minimizes fluctuation in torque.

[0016] Other features and objects of the present invention will become apparent from the following description made with reference to the accompanying drawings, in which:

Fig. 1A is a plan view of an embodiment of a disc brake of the present invention;

Fig. 1B is view of the same as seen from its outer side;

Fig. 2 is a perspective view of a torque-carrying plate embodying the invention;

Fig. 3A is a view of the same as seen in the direction of arrow A in Fig. 2;

Fig. 3B shows the shape of a different torque-carrying surface; and

Fig. 4 is a partial plan view of the disc brake according to the present invention.

[0017] Referring first to Fig. 1, the disc brake according to the present invention has a torque-carrying plate 1 formed by blanking a steel plate. This plate 1, which will be discussed later, is the point of the present invention.

[0018] The disc brake has a caliper 2 supported on a guide pin 3 fixed to the torque-carrying plate 1 so as to be slidably axially of the disc D. Pads 4 and 5 are provided opposite to each other on both sides of the disc D. They are hung on pad pins 6 axially extending through a window of the caliper 2 at the outer circumference of the disc D.

[0019] The inner pad 4, adapted to be biased by a brake piston 7, can slightly move in a tangential direction of the disc D, not restrained by the pad pins 6. During braking, its backing plate 4a abuts torque-carrying surfaces 1a of the torque-carrying plate 1.

[0020] The outer pad 5 has a backing plate 5a received in the window of the caliper 2 so that the torque produced during braking is carried by the caliper 2.

[0021] As shown in Figs. 2 and 3, the torque-carrying surface 1a of the torque-carrying plate 1 is not straight but has a zigzag section, so that their (axial) width W is larger than the thickness w of the torque-carrying plate 1 (Fig. 3A). This zigzag pattern is formed by inwardly protruding portions 8.

[0022] The inwardly protruding portions 8 may be formed by half-shearing or by ordinary pressing. The protrusions 8 shown in Figs. 2 and 3A are formed by the former method, while those shown in Fig. 3B are formed by the latter method.

[0023] As shown in Figs. 3A and 3B, the torque-carrying surface 1a is symmetrical with respect to a centerline C that divides the surface (L in length) into the inner half portion (near the center of the disc: L/2 in length) and the outer half portion (near the circumference of the

disc: L/2 in length).

[0024] Since the torque-carrying plate 1 has the torque-carrying surface 1a having a width substantially larger than the thickness of the plate 1 itself, it can support the inner pad until it is completely worn out even if it is thinner than the value determined by conventional standards. Since the surface 1a is symmetrical with respect to centerline C, the center of the surface on which the torque is actually applied is always on the centerline C, from the time when the inner pad is brand-new until it is completely worn out (in Fig. 4 from the solid line to the dotted line). Namely, the average length of moment arm remains unchanged and the torque does not change.

[0025] It is possible to omit the pad pins 6 by engaging the inner pad in a guide groove formed in the torque-carrying plate in the axial direction of the disc. But forming such a guide groove in the thin torque-carrying plate is not only difficult but will reduce the effective area of the torque-carrying surface and thus reduce reliability and durability of the brake. Thus, it is preferable to hang the pads on the pad pins.

25 Claims

1. A disc brake comprising a disc (D), a brake piston (7), an inner pad (4) and an outer pad (5) disposed opposite to each other on both sides of said disc (D) and adapted to be brought into frictional contact with said disc, and a fixed torque-carrying plate (1), characterized in that

35 said outer pad (5) is fixed to the outer portion of the caliper (2) to bear the load applied to said outer pad (5) on the caliper (2) and that said torque-carrying plate (1) bears only the load applied to said inner pad (4),
 that said inner pad (4) abuts said torque-carrying plate (1) when it is urged by said brake piston (7),
 that said torque-carrying plate (1) is adapted to carry brake torque applied to said inner pad (4),
 that said torque-carrying plate (1) has a torque-carrying surface of a zigzag shape comprising a plurality of protrusions (8) extending in the axial direction of said disc (D) so as to increase the width of said torque-carrying surface to such an extent that said inner pad (4) can be supported on said torque-carrying surface even when said inner pad (4) has been completely worn out, and
 that said torque-carrying surface is symmetrical with respect to a longitudinal centerline (C) of said torque-carrying surface.

Patentansprüche

1. Scheibenbremse, bestehend aus einer Scheibe (D), einem Bremskolben (7), einem inneren Klotz (4) und einem äußeren Klotz (5), die einander gegenüberliegend auf beiden Seiten der Scheibe (D) angeordnet und mit der Scheibe in Reibkontakt zu bringen sind, sowie einer ortsfesten Bremsmoment-Aufnahmeplatte (1),
dadurch gekennzeichnet, dass

der äußere Klotz (5) an dem äußeren Bereich des Sattels (2) befestigt ist, um die Last zu tragen, die auf den äußeren Klotz (5) auf dem Sattel (2) ausgeübt wird, und dass die Bremsmoment-Aufnahmeplatte (1) nur die Last trägt, die auf den inneren Klotz (4) wirkt,
dass der innere Klotz (4) an die Bremsmoment-Aufnahmeplatte (1) anstößt, wenn er durch den Bremskolben (7) beaufschlagt wird,
dass die Bremsmoment-Aufnahmeplatte (1) dazu dient, das Bremsmoment aufzunehmen, das auf den inneren Klotz (4) wirkt,
dass die Bremsmoment-Aufnahmeplatte (1) eine Bremsmoment-Aufnahmefläche mit Zickzackform besitzt, die eine Vielzahl von Vorsprüngen (8) aufweist, welche sich so in axialer Richtung der Scheibe (D) erstrecken, dass die Breite der Bremsmoment-Aufnahmefläche in einem solchen Maß vergrößert wird, dass der innere Klotz (4) selbst dann auf der Bremsmoment-Aufnahmefläche auflagern kann, wenn der innere Klotz (4) vollständig abgenutzt ist, und
dass die Bremsmoment-Aufnahmefläche in Bezug auf eine längliche Mittellinie (C) der Bremsmoment-Aufnahmefläche symmetrisch ist.

5 10 15 20 25 30 35

40

Revendications

1. Frein à disque comprenant un disque (D), un piston de frein (7), un patin intérieur (4) et un patin extérieur (5) disposés à l'opposé l'un de l'autre des deux côtés du disque (D) et adaptés à être amenés en contact de friction avec ledit disque, et une plaque d'encaissement de couple fixe (1),
caractérisé en ce que

45 50 55

ledit patin extérieur (5) est fixé sur la partie extérieure de l'étrier (2) pour supporter la charge appliquée audit patin extérieur (5) sur l'étrier (2), et en ce que ladite plaque d'encaissement de couple (1) supporte uniquement la charge appliquée audit patin intérieur (4),
ledit patin intérieur (4) vient buter contre la plaque d'encaissement de couple (1) lorsqu'il est

sollicité par ledit piston de frein (7),
ladite plaque d'encaissement de couple (1) est adaptée à supporter le couple de freinage appliqué audit patin intérieur (4),
ladite plaque d'encaissement de couple (1) présente une surface d'encaissement de couple en forme de zigzag comprenant une pluralité de saillies (8) s'étendant dans la direction axiale dudit disque s'étendant dans la direction axiale dudit disque (D) de façon à augmenter la largeur de ladite surface d'encaissement de couple dans une mesure telle que ledit patin intérieur (4) peut être supporté sur ladite surface d'encaissement de couple même lorsque ledit patin intérieur (4) a été complètement usé, et ladite surface d'encaissement de couple est symétrique par rapport à une ligne centrale longitudinale (C) de ladite surface d'encaissement de couple.

FIG. 1A

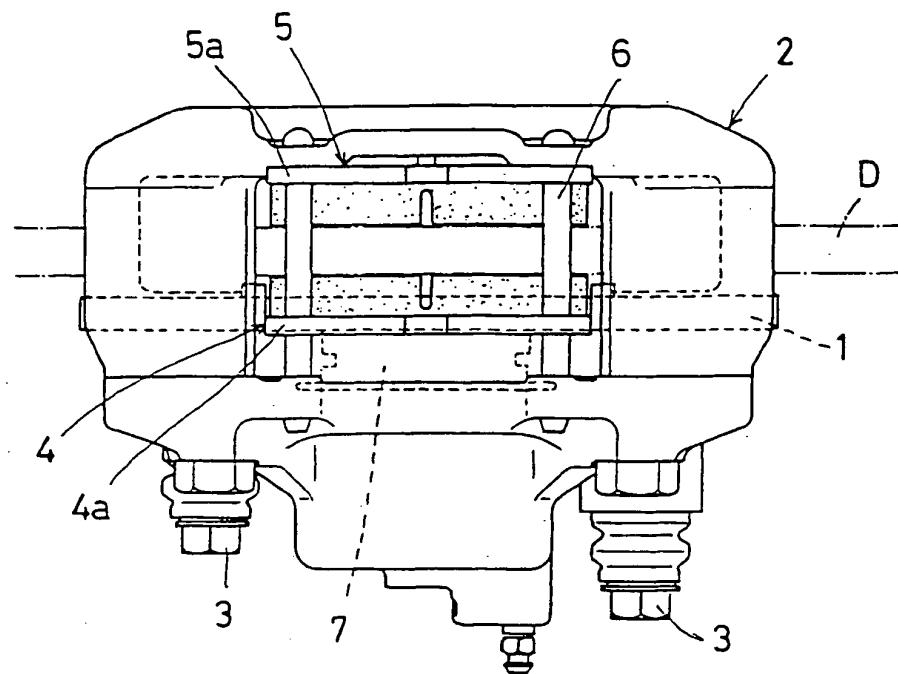


FIG. 1B

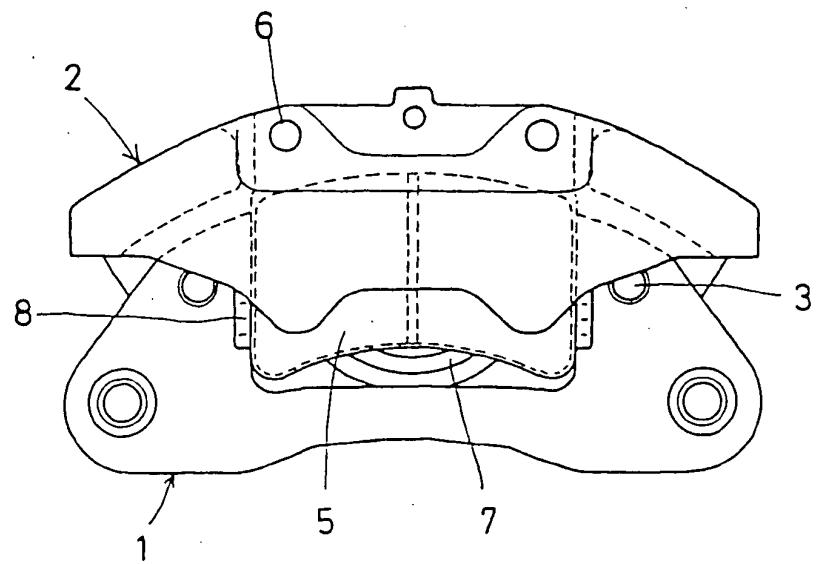


FIG. 2

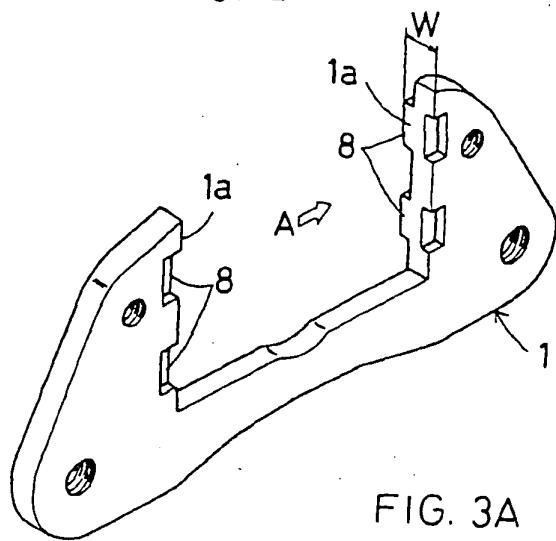


FIG. 3A

FIG. 3B

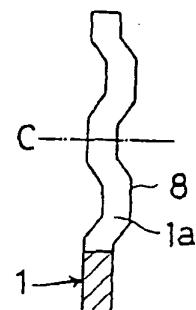
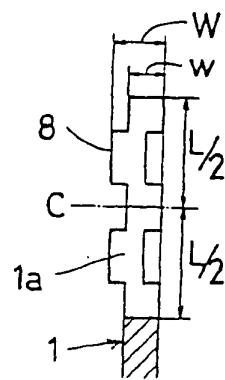


FIG. 4

